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Spatial distribution, origin and source and sink areas of marine litter in the water column of the North Sea

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Marine litter, in particular plastic, is becoming an increasing issue in marine ecosystems worldwide. Most marine litter studies are based on surface sampling, beach or bottom trawl surveys, whereas information on marine litter in the water column is rather scarce. In the present study, we utilize an existing herring larvae survey, intended to produce a recruitment index used in fish stock assessment, for opportunistic sampling of marine litter. The survey is covering the entire North Sea and the sampling gear is covering the water column from the surface to 3 meter above the sea floor, providing a unique opportunity to analyze the spatial distribution of different types of marine litter floating in the water column. The characteristics of the litter items such as size, shape and color give indications from which sea- or land-based sources they may originate. The vast majority of collected litter items are different types of plastic materials, and of these the most abundant types are monofilaments, foils, fragments and synthetic rope. The monofilament plastic strings are likely originating from fishing activities, in particular from so-called “dolly ropes”. These “dolly ropes”, short pieces of synthetic rope, are attached to the cod ends of fishing nets to protect them from wear and tear, a practice that is particularly common in beam trawl fisheries. The spatial distribution of these plastic strings shows distinct, annually recurring patterns, which in connection with information from beach surveys, spatial patterns of fishing activity and prevailing currents indicate the existence of source and sink areas of marine litter in the North Sea. There are several negative effects of marine litter, e.g. reduced attractivity of polluted beaches which may influence tourism, entanglement of marine mammals and seabirds in lost fishing nets and other litter items or the ingestion of litter by marine species which potentially results in constipation and death. A particular issue concerning “dolly ropes” is the fact that sea birds are mistaking these plastic threads for sea weed and use them to build their nests, which can cause them to get entangled and strangled.